

March 1992

# INFANTRY ANTITANK WEAPONS TESTS

## Assessment of the Army's Test and Evaluation of the Dragon II and BILL



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**National Security and  
International Affairs Division**

B-247888

March 16, 1992

The Honorable Sam Nunn  
Chairman, Committee on Armed Services  
United States Senate

The Honorable Les Aspin  
Chairman, Committee on Armed Services  
House of Representatives

The National Defense Authorization Act for Fiscal Years 1990 and 1991 (P.L. 101-189) requires the Army to conduct a side-by-side test and evaluation of the Dragon II, the Bofors Infantry Light and Lethal (BILL), and the Milan<sup>1</sup> antitank weapons. The act also requires the Army to select the superior system as an interim system (until the Army's new system called Javelin is fielded), giving full consideration to cost effectiveness and the following six performance measures: tank killing capability, gunner survivability, portability by field troops, countermeasures vulnerability, system reliability, and safety. The act also requires us and the Director of Operational Test and Evaluation to provide assessments of the test and evaluation not later than 2 months after the end of the tests.

On January 14, 1992, the Army completed its evaluation. Therefore, as required by the act, we are providing our assessment. We are also providing information regarding (1) whether additional tests are needed and (2) potential Dragon II improvements. Our scope and methodology are in appendix I.

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**Results in Brief**

The Army conducted a series of tests and evaluations and selected the currently deployed U.S. Dragon II over the Swedish BILL. However, the Army did not fully comply with all provisions of the act because it limited its testing primarily to tank-killing capability, or lethality. According to the Army, only limited tests were conducted because of limited funding.

Although the Army's lethality tests and assessments appear to have been conducted in a reasonable manner, the Army's tests did not provide sufficient information to select the superior system. For example, gunner survivability tests were inadequate and inconclusive.

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<sup>1</sup>The Milan was not tested because the contractor withdrew the system from competition.

Further testing of the Dragon II and BILL, however, may no longer be warranted. The Army has already fielded the Dragon II and even if the BILL were selected as a supplemental interim system, the earliest its fielding could begin is only 17 months before the Army's scheduled fielding for the Javelin. In addition, the dissolution of the Soviet Union since the act may have reduced the threat and need for a supplemental interim system.

If an enhanced interim capability becomes necessary because of changes in the threat or slippages in the Javelin schedule, consideration could be given to further improvements to the Dragon II as an alternative to the BILL. Although the upgrades may not offer earlier fielding than the BILL, the improvements would cost significantly less than BILL and provide greater capabilities than Dragon II.

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## Background

The Army is developing the Javelin—formerly called the Advanced Antitank Weapon System-Medium (AAWS-M)—to replace the Dragon II antitank weapon. The Javelin is now in the 33rd month of a 54-month development program and fielding is scheduled for April 1996.

In 1985, the Army adopted the Dragon II—a Dragon I missile with an improved warhead—as the interim medium antitank system until the Javelin is fielded. However, since then the Congress has periodically expressed concerns over the Dragon II's ability to effectively fulfill its interim role and whether an enhanced interim capability is needed.

Both the Dragon II and BILL are wire-guided antitank weapons with detachable day and night sights (trackers). Dragon II is designed to follow the gunner's line-of-sight to the target where the warhead is detonated by an impact fuze. The BILL, on the other hand, is designed to fly above the gunner's line-of-sight and over the target where the warhead detonates and the resulting penetrating jet strikes the top of the target.

Table 1 compares the operational characteristics of the Dragon II and BILL weapon systems.

**Table 1: Comparison of Operational Characteristics**

<b>Description</b>	<b>Dragon II</b>	<b>BILL</b>
Range	65 to 950 meters	150 to 2,000 meters
Portability	One person with one missile or two people with two missiles	Three or four people with either one or two missiles
Flight time	10.2 seconds to 900 meters	11 seconds to 2,000 meters
May defeat more formidable armor	No	Yes
System weight with one missile	73 pounds	109 pounds

## Army Tests, Evaluations, and System Selection

As required by the act, the Army conducted some side-by-side tests to assess the Dragon II and BILL as interim medium antitank candidates. It also established an evaluation team that considered the results of side-by-side tests, reviewed the results of earlier tests, and obtained the opinions of subject matter experts. Based on the team's findings, the Secretary of the Army selected the Dragon II as the superior system.

## Side-by-Side Tests

The Army conducted remotely-fired technical tests at the Redstone Arsenal, Alabama, and soldier-fired tests at Fort Benning, Georgia, from November 1990 through July 1991. Technical tests included flight tests without a gunner and other tests designed to measure missile and warhead effectiveness. Soldier-fired tests involved firing nonlethal warheads at selected targets to determine the probability of hitting the target.

## Evaluations

The evaluation team concluded that the BILL and Dragon II were about equal in lethality (the measure considered by the Army to be the most important). Generally, Dragon II had a higher probability of hit, but BILL had a higher probability of kill, given a hit. In addition, among other factors, the team concluded that both systems were essentially equal regarding immunity to countermeasures, with a slight advantage to BILL; both systems were equally supportable and reliable; and, although both systems were too heavy, Dragon II was more portable with a two-person crew than BILL with a four-person crew.

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## System Selection

Since the evaluation team judged the BILL and Dragon II as equally lethal, the Secretary of the Army chose the Dragon II to remain as the Army's interim medium antitank system because (1) procuring, fielding and sustaining the BILL would cost more than sustaining the already procured and fielded Dragon II and (2) the heavier BILL system presents potential organizational and operational problems.

The evaluation team estimated the cost to procure, field and sustain the BILL over a 5-year deployment at \$461.8 million (constant 1992 dollars). However, the estimated cost to sustain the already deployed Dragon II over 5 years was only \$159.9 million.

In addition, because the BILL is heavier than the Dragon II, Army infantry representatives believed that its deployment in light infantry divisions would adversely impact force structure since at least one additional soldier would be required to carry the system. They also objected to the BILL because (1) unlike the Dragon II, it cannot be carried by an individual paratrooper when jumping from an aircraft and (2) its minimum engagement range is more than twice Dragon II's—150 versus 65 meters.

More specific data on test results are not provided in this report because they are classified.

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## Army Testing Did Not Fully Comply With the Act

The Defense Authorization Act for Fiscal Years 1990 and 1991 required side-by-side testing of six performance measures, but the Army did not fully comply with the act. For example, it did not adequately compare gunner survivability during either previous or current testing. In addition, the evaluation team used 1988 and 1989 test data in an attempt to address other performance measures, such as countermeasures vulnerability and portability. However, this data was not obtained in side-by-side testing.

We discussed the Army's noncompliance with a representative of the Army General Counsel. The representative agreed that the Army did not fully comply with the act but cited limited funding and agreements with selected Members of Congress as mitigating factors.

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## Lethality Tests Were Reasonable

The Army's lethality tests and assessments appear to have been conducted in a reasonable manner. The lethality formula used by the Army appears complete. It took into account (1) probable system malfunctions and gunner errors and (2) the probability of killing a specific type target at a particular range and angle, provided the gunner hits the target (warhead effectiveness). In addition, the data for computing these factors appears to have been obtained fairly.

Tests for system malfunctions and gunner errors, for example, involved soldiers firing live, nonlethal BILL and Dragon II missiles at moving and stationary targets out to about 1,000 meters. The BILL was also fired at targets between 1,001 and 2,000 meters. The soldiers, who were previously inexperienced with antitank weapons, were trained by the respective system contractors. Army evaluators scored hits and misses, and they attributed the misses to either system failure or gunner error.

Similarly, data for computing warhead effectiveness appears to have been obtained in a fair and reasonable manner. Comparable warhead effectiveness data was obtained during technical test firings. The technical test warheads were detonated remotely—gunners were not used—at various angles into targets representative of threat armors. The Army Materiel Systems Analysis Activity made final determinations on the probability of kill.

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## Inadequate Basis for System Selection

The Army's tests did not provide sufficient information to select the superior system. For example, gunner survivability tests were inadequate and inconclusive. The Director of the Department of Defense's Operational Test and Evaluation stated that the lack of survivability testing was also a primary flaw in the fiscal year 1989 testing.

The BILL system's maximum range is more than twice that of Dragon II (2,000 versus 950 meters). The Army's 1991 test plan acknowledged that the longer range capabilities of BILL may improve its survivability; but it also acknowledged that no credible data existed to assess the possible improvement and that none would be obtained. Furthermore, an appendix to the evaluation report states that engagement range is critical because a tank's capability to identify and destroy antitank systems is significantly degraded at extended ranges.

However, the Army did not test the potential for increased operational effectiveness and gunner survivability as a consequence of significantly

greater range. The testing included a limited evaluation of the impact of range on gunner survivability based on the systems' detectability—smoke and system visibility—as recorded by video cameras placed out to about 800 meters. According to test officials, evaluators subjectively assessed system detectability from the recordings. However, the Army's tests did not obtain the data to compare the Dragon II's detectability and susceptibility to counterfire at its maximum range of 950 meters versus the BILL's detectability and susceptibility to counterfire at its maximum range of 2,000 meters.

### Additional Testing May No Longer Be Warranted

Although the Army did not conduct all required tests, further testing of the Dragon II and BILL may no longer be warranted. The Army has already fielded the Dragon II and, according to an Army evaluation team official, even if the BILL was selected as a supplemental interim system, its fielding could not begin until 17 months before the Javelin's scheduled fielding. In addition, the dissolution of the Soviet Union since the act may have reduced the threat and need for a supplemental interim system.

### BILL's Deployment Period and Cost

According to an Army evaluation team official, even if additional survivability testing were to support selection of the BILL as the Army's interim system, the system could not be fielded before November 1994. He said more time would be required to (1) test and certify the system for U.S. Army use and (2) negotiate contract terms, award a production contract, and obtain missiles for deployment. Based on the official's estimates, table 2 shows the events that would have to occur before the BILL could be fielded.

**Table 2: Deployment Period for the BILL**

Date	Event
October 1992	Fiscal year 1993 funds become available <sup>a</sup>
January 1993	Contract award for test hardware
September 1993	Completion of survivability and certification tests
June 1994	Contract award for deployment hardware
November 1994	BILL initial fielding <sup>b</sup>
April 1996	Javelin initial fielding
November 1994 to April 1996	17-month period for BILL deployment until Javelin fielding

<sup>a</sup>For planning purposes, funding is assumed to be available at the beginning of fiscal year 1993.

<sup>b</sup>According to the BILL system contractor, production planned for the Swedish Army would be diverted to producing BILLs for the United States immediately after contract award. The contractor believed fielding could begin in September 1994.

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Although not a part of the evaluation team's assessment, a member of the team estimated \$287 million would be required to deploy the BILL and sustain it for a 2-year period. The estimate is based on buying 2,468 missiles and 354 launchers, tripods, and day and night sights. That would be enough to equip two divisions and a ranger regiment.

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### Diminished Soviet Threat

Although not the sole threat facing the United States and its allies, the severe threat posed by the former Soviet Union may be significantly reduced. Changes in the military capability in that region and the likelihood of confrontation with the West may have reduced the need for an enhanced interim antitank capability.

On January 26, 1992, the Director of the Defense Intelligence Agency testified before the Senate Armed Services Committee concerning the likelihood of super power confrontation. He saw virtually no likelihood of premeditated Russian or commonwealth military aggression against the United States and its allies. He said that the intentions of the new commonwealth states towards the West have clearly changed; and, overall, the military capabilities of Russia and the successor states are in profound decline.

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### Other Alternatives Available

If changes should occur in the threat or Javelin's schedule, consideration could be given to Dragon II improvements as an alternative to the BILL. Although system fielding may be later than the BILL, the upgrade would increase Dragon II's performance, cost less than the BILL, and reduce the organizational and operational problems associated with the BILL.

The upgrade includes a tandem warhead to increase lethality, particularly against more formidable armor; an improved launch motor to decrease launch detectability; and a flight motor to increase range and speed. According to contractor information, maximum range would increase to 1,500 meters.

Since the improvements could be fielded by retrofitting the existing Dragon II, procurement and force integration costs would be less than for the BILL; and operational and organizational impacts should be substantially less. For example, the contractor estimates retrofit costs for each Dragon II to be about \$15,000 versus procurement costs of about \$222,000 for each BILL system. In addition, since firing procedures for the upgrade are the same as for the Dragon II, changes to the training

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procedures and retraining would be unnecessary. Also, according to a Dragon project engineer, the upgrade could be carried by paratroopers when jumping from aircraft, and it is one-person portable.

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We are sending copies to the Chairmen of the Senate Committees on Appropriations and on Governmental Affairs and the House Committees on Appropriations and on Government Operations, the Secretaries of Defense and the Army, and the Director of the Office of Management and Budget. Copies will also be made available to other interested parties on request.

Please call me at (202) 275-4141 if you or your staff have any questions. Major contributors to the report are listed in appendix II.



Richard Davis  
Director, Army Issues



# Scope and Methodology

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We reviewed the test plan and discussed it with representatives of the Army Operational Evaluation Command, Alexandria, Virginia. In addition, we discussed test issues with officials from the Office of the Assistant Secretary of the Army (Research, Development and Acquisition) and with officials from the Army's Ballistic Research Laboratory, Army Materiel Systems Analysis Activity, and Human Engineering Laboratory.

To evaluate the conduct of the testing, we observed warhead penetration tests at Redstone Arsenal, Alabama, and soldier firings of live missiles at Fort Benning, Georgia. We also met with representatives of the Army Infantry School at Fort Benning to obtain user perspectives on Dragon II and other potential interim antitank candidates.

In assessing the Army's January 1992 evaluation report, we discussed the sources and methodology used in developing the report with various evaluation team participants; we obtained information regarding the procedures used for obtaining the data; and we tested, to the extent feasible, the validity of that data.

We also obtained limited information on the cost, performance and fielding of Dragon improvements from Army and contractor officials responsible for the Dragon.

We discussed the information in this report with Office of the Secretary of Defense and Army officials and have incorporated their views as appropriate.

We performed our work from November 1990 to March 1992 in accordance with generally accepted government auditing standards.

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# Major Contributors to This Report

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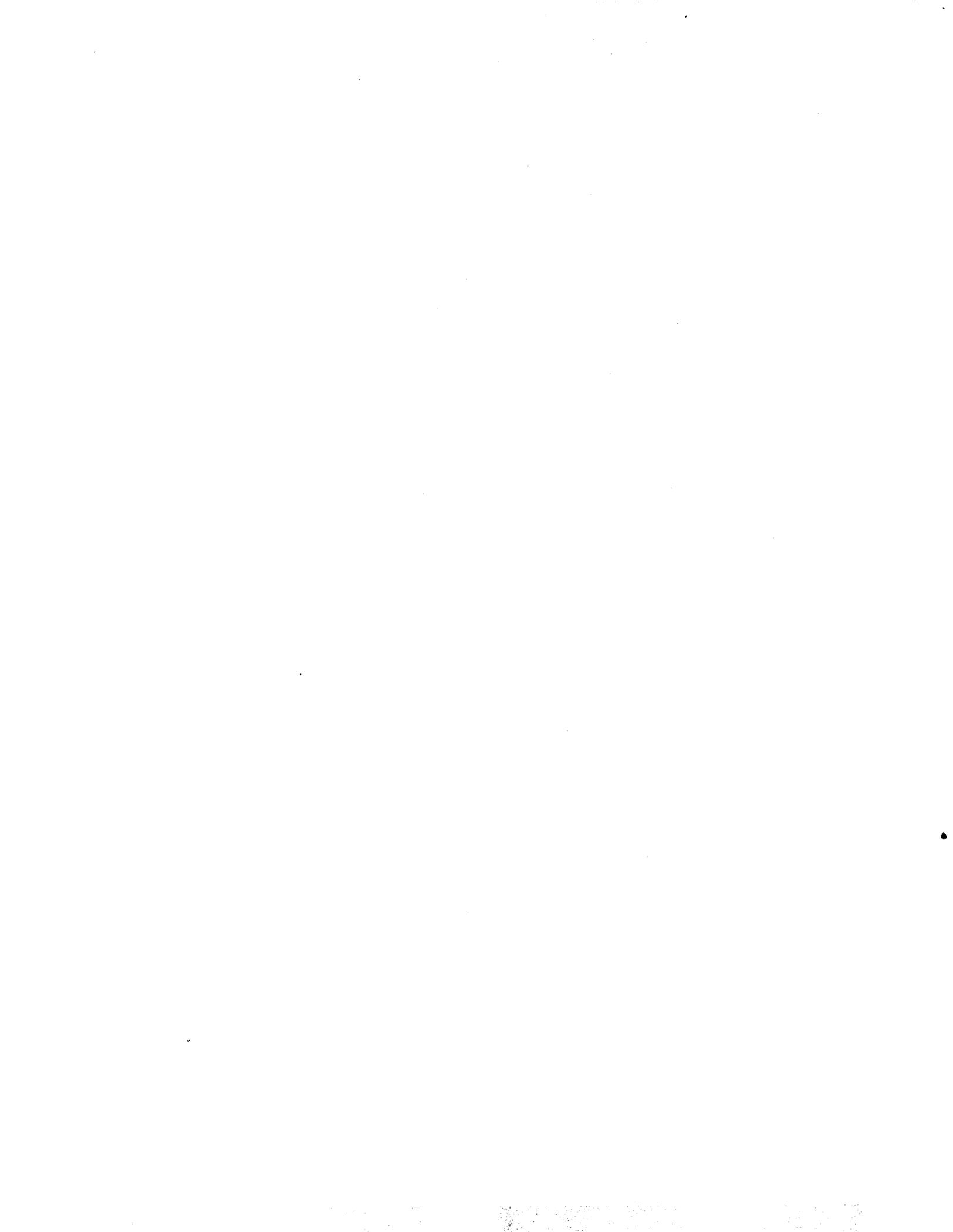
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